



# Juno Update

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# Juno Status



- Launched August 2011
- Earth flyby October 2013
- Jupiter arrival July 4, 2016
- Spacecraft is healthy and all instruments are working.



# Juno's Science Objectives



## Origin

Determine O/H ratio (water abundance) and constrain core mass to decide among alternative theories of origin.

## Interior

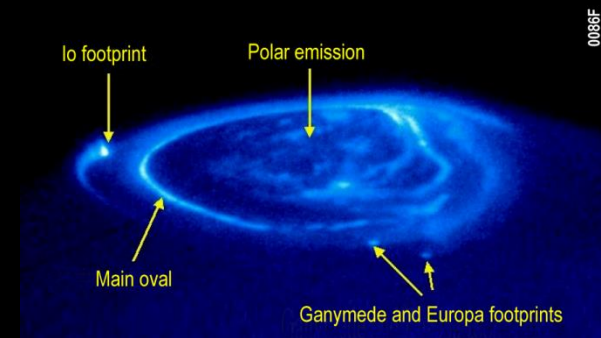
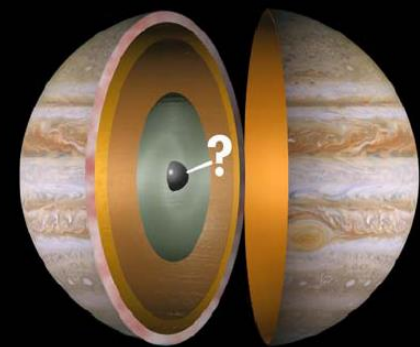
Understand Jupiter's interior structure and dynamical properties by mapping its gravitational and magnetic fields

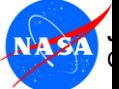
## Atmosphere

Map variations in atmospheric composition, temperature, cloud opacity and dynamics to depths greater than 100 bars at all latitudes.

## Magnetosphere

Characterize and explore the three-dimensional structure of Jupiter's polar magnetosphere and auroras.





# Juno Payload



**X and Ka Band Gravity Science (JPL/ASI)**

**Magnetometer— MAG/ASC (GSFC/DTU)**

**Microwave Radiometers— MWR (JPL)**

**Energetic Particle Detectors—JEDI(APL)**

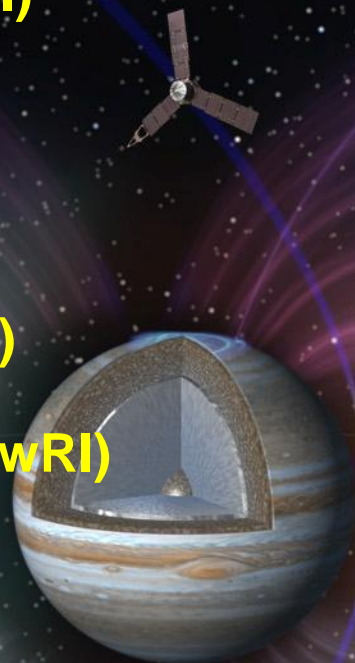
**Jovian Auroral Distributions — JADE (SwRI)**

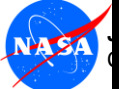
**Waves (U of Iowa)**

**UV Spectrograph— UVS (SwRI)**

**Visible Camera - JunoCam (Malin)**

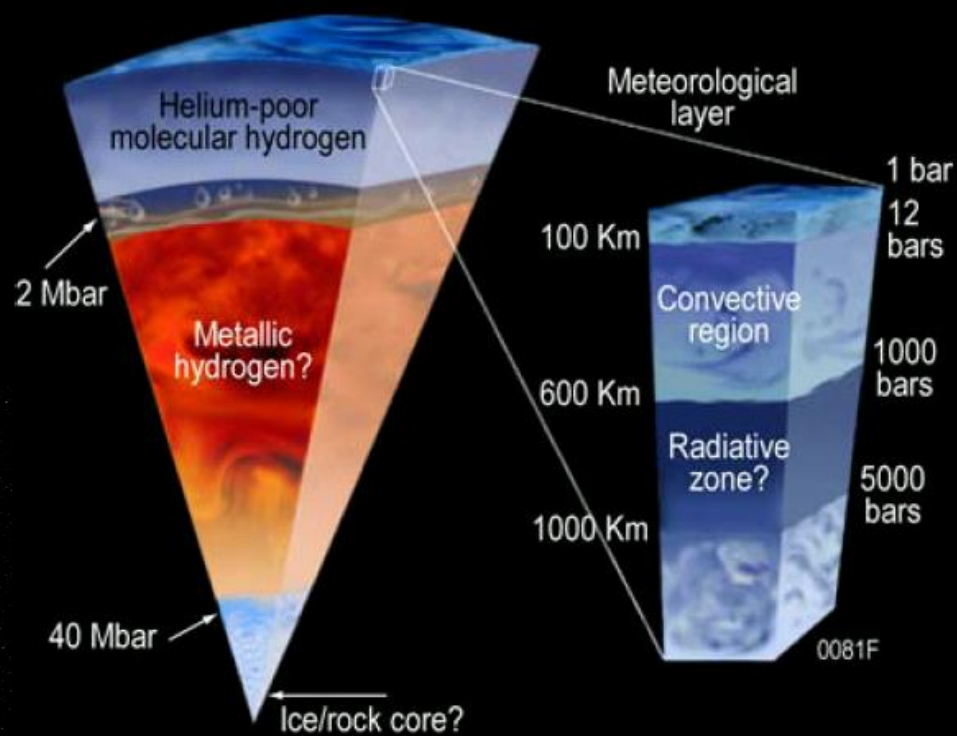
**IR Camera/Spectrometer –JIRAM (ASI)**





# Probing the deep interior from orbit

Juno maps Jupiter from the deepest interior to the atmosphere using microwaves, magnetic and gravity fields.

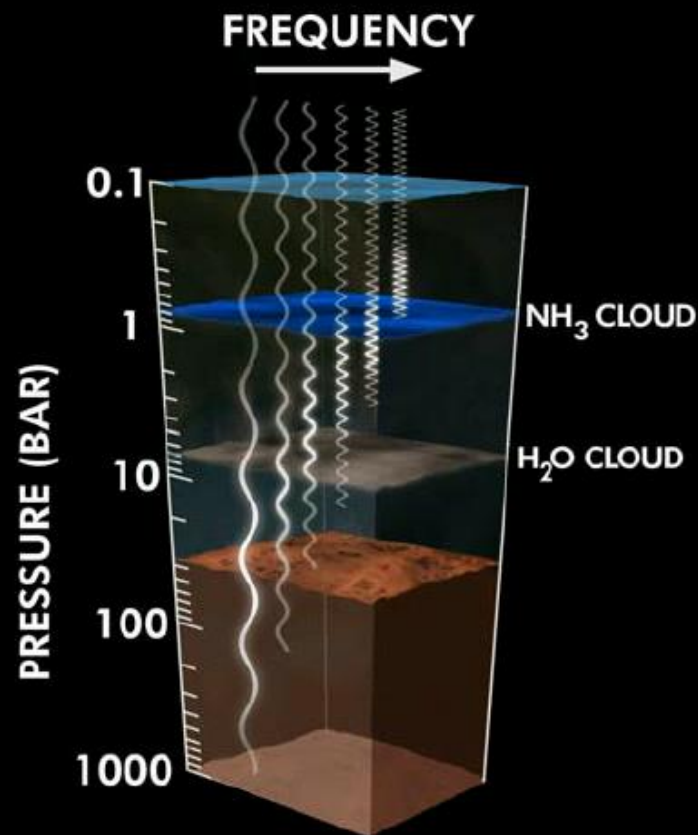
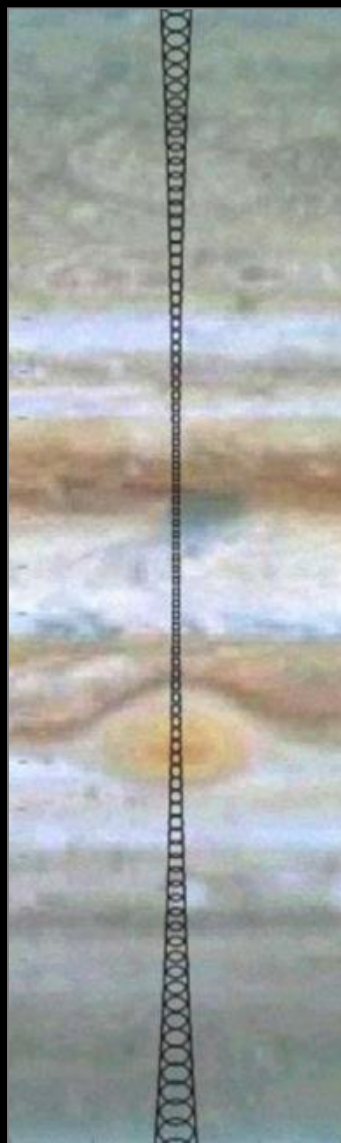


# Sensing the deep atmosphere

**Juno's Microwave Radiometer measures thermal radiation from the atmosphere**

**1000 atmospheres pressure (~500-600km below the visible cloud tops).**

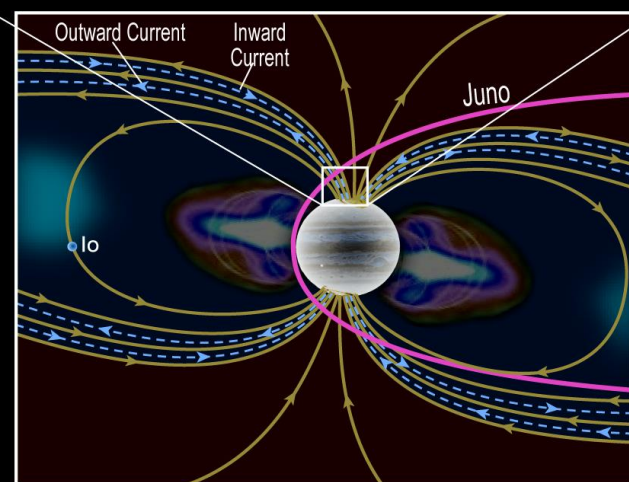
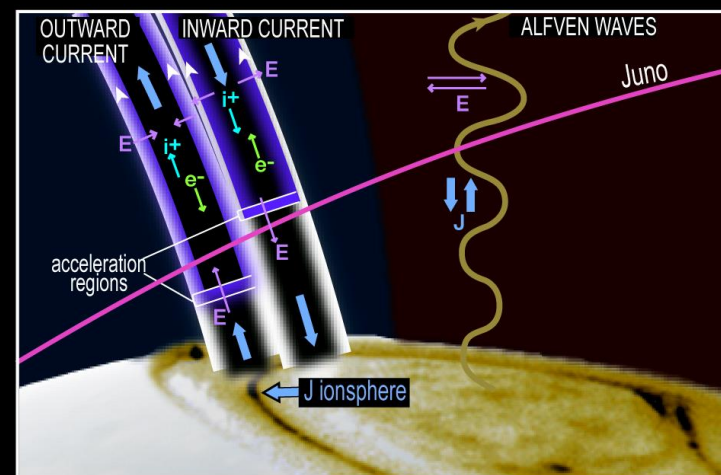
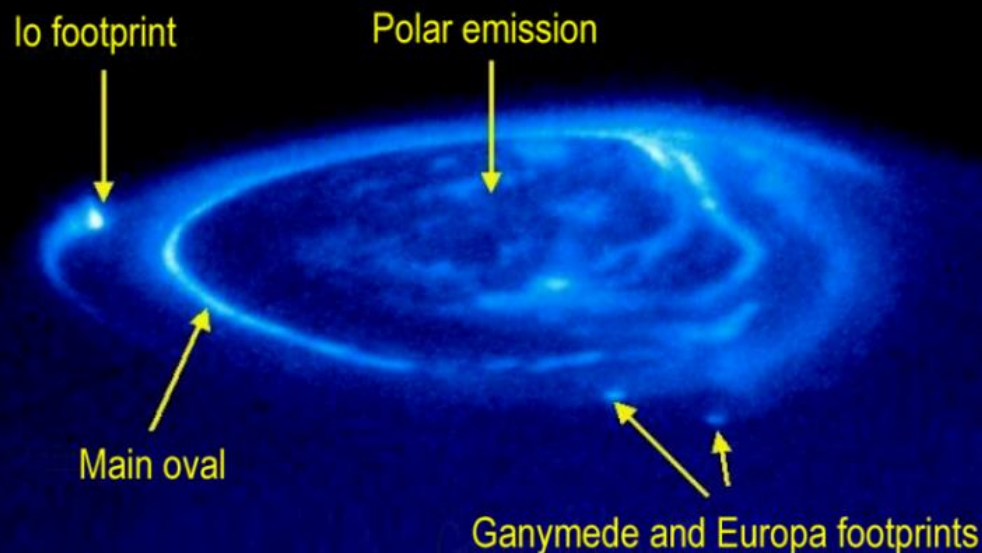
**Determines water and ammonia abundances in the atmosphere all over the planet**



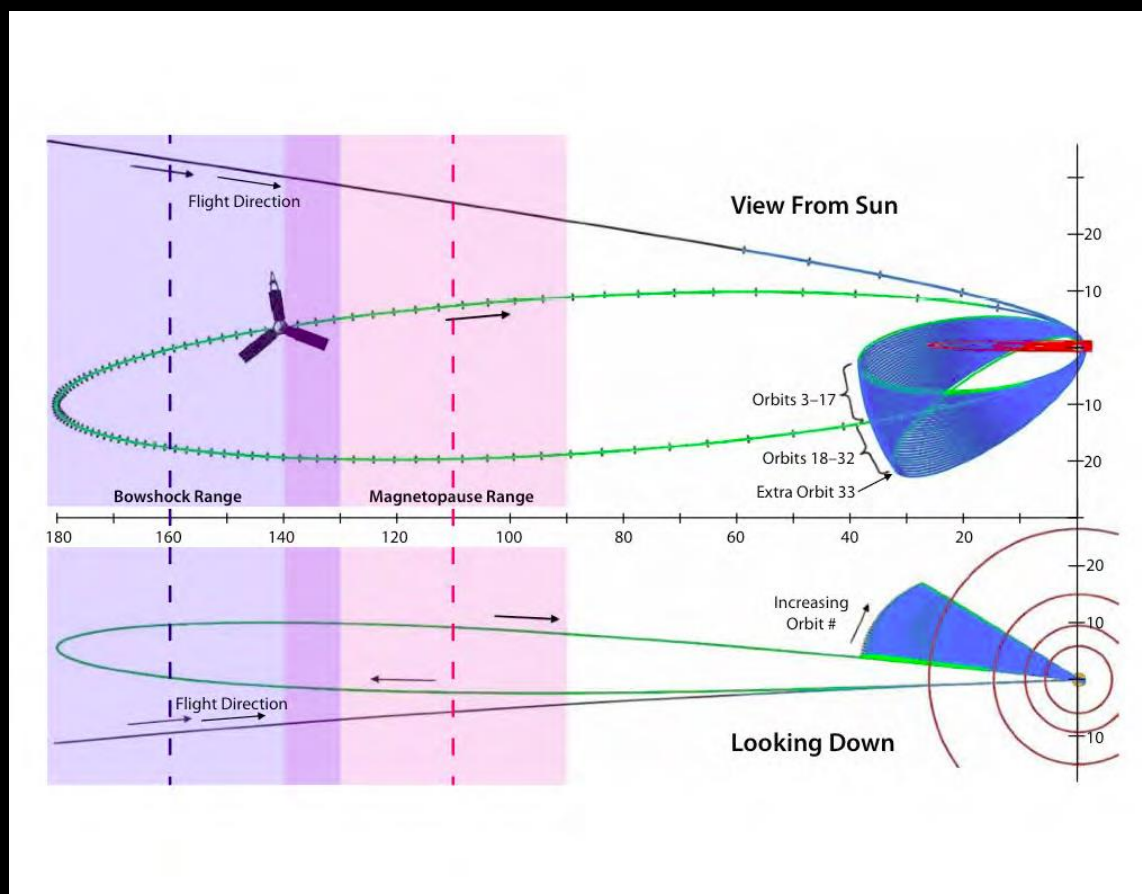
# Polar Magnetosphere Exploration

**Location is Key: Juno passes directly through auroral field lines.**

**A suite of instruments are used to understand the physics:  
JADE, JEDI, MAG, Waves, JIRAM, UVS**

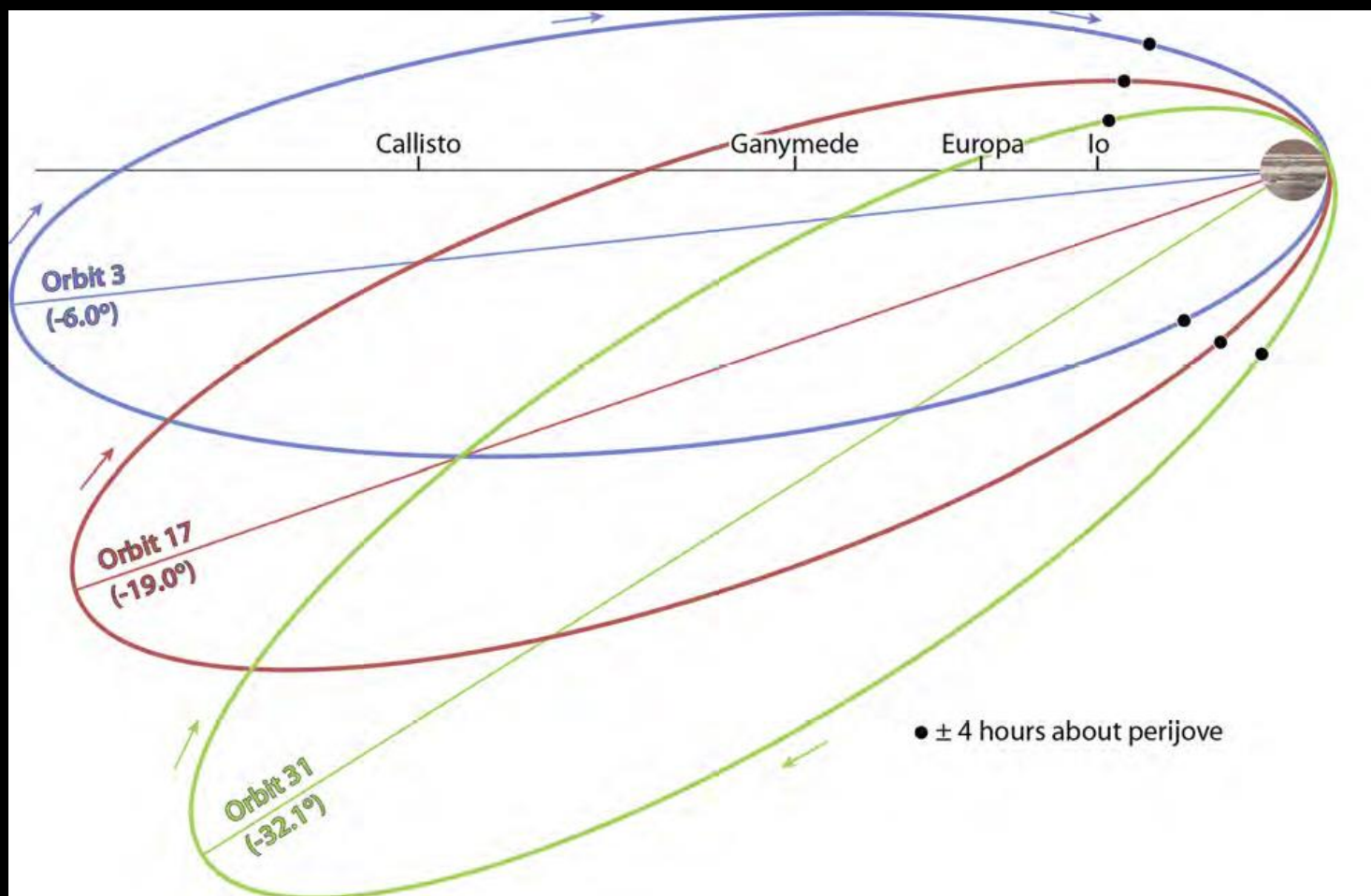


# Juno Orbit Geometry

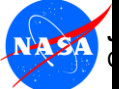


Geometry of *Juno's* orbits viewed with the dawn flank on the left, (top) from the Sun with north up, and (bottom) looking down on the system, the Sun below.

# Juno Orbit Geometry



Three Juno orbits: showing precession of line of apsides relative to Jupiter's geographic equator.

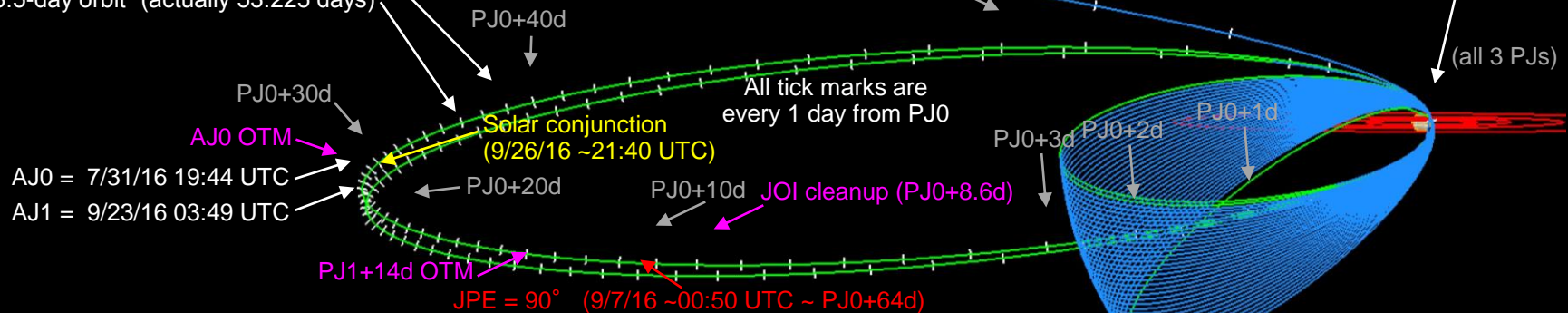


# Overview of two 53.5 day orbits and PJ1

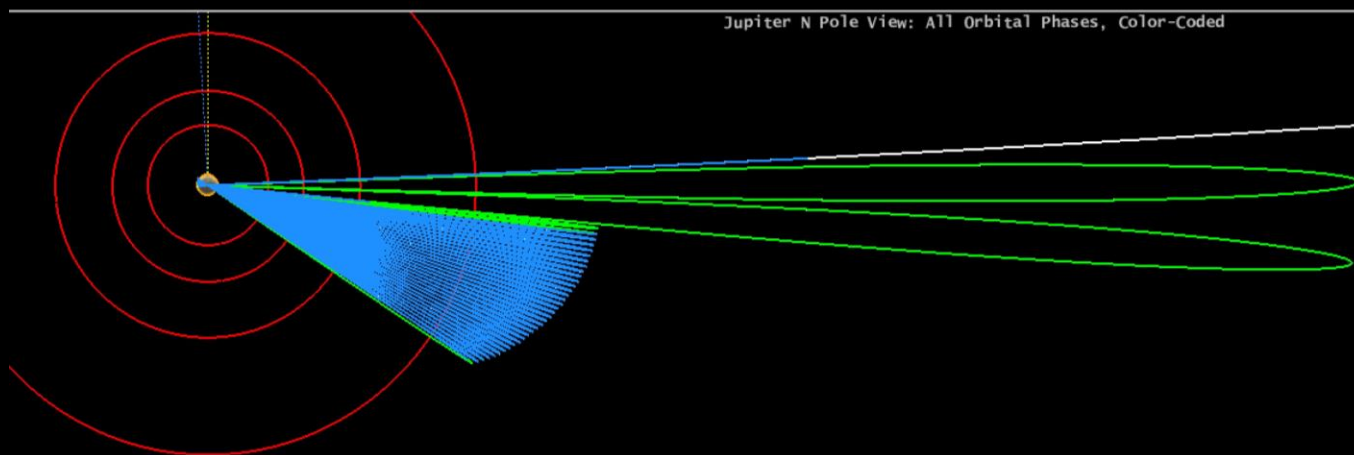
Earth to Jupiter View: All Orbital Phases, Color-Coded  
2016/10/19 18:00:00.0000 UTC

"1st 53.5-day orbit" (actually 53.422 days)

"2nd 53.5-day orbit" (actually 53.225 days)



Jupiter N Pole View: All Orbital Phases, Color-Coded

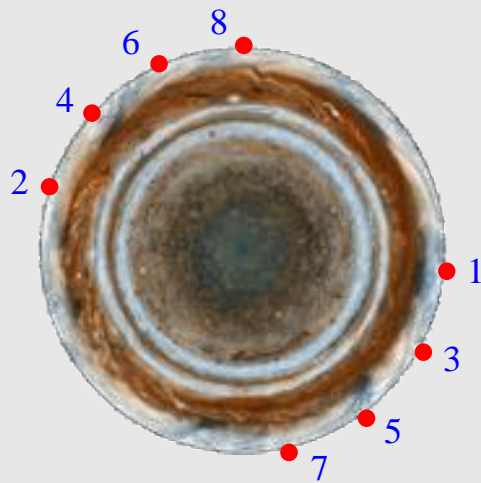
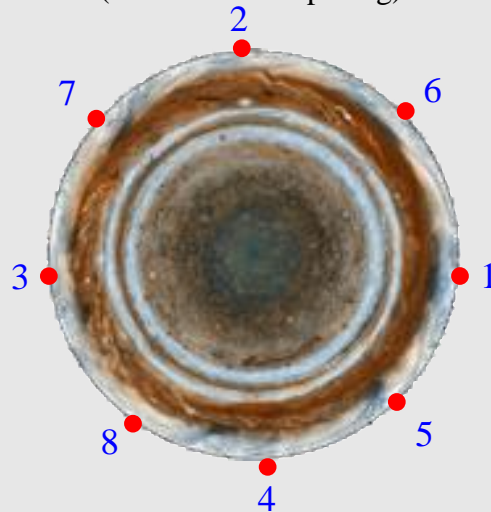
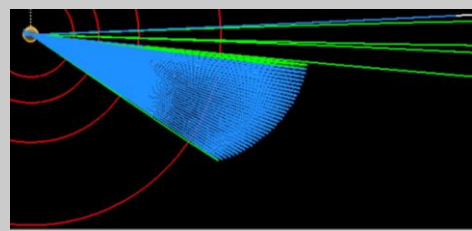


# Science Orbit Alternate – 14-days

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- Advantages:
  - Juno cruise experience and examination of historical databases suggest safe mode recovery times on order 3-5 days (plus instrument turn-on) or longer for unknown root causes.
    - 3 additional days is significant for safe mode recovery
    - 11 day orbit contains 1 day of margin to maintain back-up OTM and further delay progressively degrades planned science at the next perijove
    - 14 days provides 3 days of margin (on average) to maintain back-up OTM and reduces degradation to planned perijove science
  - Longitude build up provides global coverage earlier in the mission – builds up in quadrants v. hemispheres.
  - Advantages of operational schedule to syncing up with 7-day week are intuitive and hard to quantify or characterize – key to remember that cadence is for duration of 1+ years.

# Science Orbit Alternate : 14-days

Baseline : 11-day	14-day	Design Constraints
11-day period, 30 orbits completes grid Duration from PRM +1 spare : 363d OTM & Deorbit $\Delta V$ : ~116 m/s	14-day period, 32 orbits completes grid Duration from PRM + 1 spare : 490d OTM & Deorbit $\Delta V$ : ~150 m/s	<ul style="list-style-type: none"> <li>Final longitude spacing of 12 degrees or better</li> <li>Longitude map build up retains coarse mapping followed by fine mapping</li> <li>Perijove passes over Goldstone DSN complex (DSS-25 for Ka-Band)</li> </ul>
Longitude Mesh through First Quarter ( $192^\circ$ W Lon spacing) 	Longitude Mesh through First Quarter ( $270^\circ$ W Lon spacing) 	
Rotation of Orbit (NON-Sun : $35^\circ$ max)  <p>NON = Negative Orbit Normal</p>	Rotation of Orbit (NON-Sun : $44^\circ$ max) 